

WEST GOSHEN SEWER AUTHORITY

2017 ANNUAL CONSULTING ENGINEER'S REPORT WASTEWATER SYSTEM

March 2018



[BUILDING RELATIONSHIPS.
DESIGNING SOLUTIONS.]

**2017 ANNUAL CONSULTING ENGINEER'S REPORT
WEST GOSHEN SEWER AUTHORITY
CHESTER COUNTY, PENNSYLVANIA**

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	OVERVIEW OF WEST GOSHEN SEWER AUTHORITY SYSTEM	1
1.2	ASSESSMENT, NEEDS, AND DRIVERS	1
2.0	ACKNOWLEDGEMENTS	2
3.0	ADDITIONAL INFORMATION USED TO COMPLETE THIS REPORT	3
4.0	CAPITAL IMPROVEMENT CAMPAIGN	4
4.1	2015 CAPITAL IMPROVEMENT PLAN (CIP).....	4
4.2	SUMMARY OF CAPITAL WORK COMPLETED IN 2017	5
5.0	WASTEWATER TREATMENT PLANT PRIORITIZATION	8
5.1	OVERVIEW.....	8
5.2	HEADWORKS.....	8
5.3	SOLIDS HANDLING	9
5.4	CLARIFIERS	12
5.5	TRICKLING FILTER.....	13
5.6	AERATION (BLOWERS AND AERATION TANKS).....	14
5.7	PLANT INTERMEDIATE PUMP STATION	15
5.8	ELECTRICAL	15
6.0	PUMP STATIONS.....	16
6.1	#1 MONTGOMERY AVENUE.....	16
6.2	#2 TRINITY DRIVE	19
6.3	#3 SPRUCE AVENUE	21
6.4	#6 ELLIS LANE.....	23
6.5	#11 TAYLOR RUN	27
6.6	#12 WASHINGTON STREET	29
6.7	#13 WESTTOWN WAY.....	32
6.8	#16 FERN HILL (NORTHEAST).....	35
6.9	#17 HAMILTON WOODS	37
7.0	COLLECTION SYSTEM	38

1.0 INTRODUCTION

1.1 OVERVIEW OF WEST GOSHEN SEWER AUTHORITY SYSTEM

West Goshen Sewer Authority (Authority) owns, and West Goshen Township (Township) operates and maintains, the sanitary sewer system which provides public sanitary sewer service to West Goshen Township, as well as portions of West Whiteland Township, East Goshen Township, Westtown Township, and a shopping center in Thornbury Township.

In 2017, the Authority updated their intermunicipal agreements with East Goshen Township and Thornbury Township. The agreements with West Whiteland Township and Westtown Township have not yet been updated.

1.1.1 COLLECTION & CONVEYANCE SYSTEM

The existing sanitary sewer collection system consists of approximately 225 miles of gravity sewers ranging in size from 8-inches to 30-inches in diameter.

1.1.2 CONVEYANCE SYSTEM – PUMP STATIONS

The Authority currently owns ten (10) wastewater pump stations throughout the collection and conveyance system. The pump stations consist of wet pit submersible style pumps (pumps are located in the sewage being pumped) or dry pit submersible style pumps (pumps are located in a separate dry well physically separated from the liquid being pumped). Two (2) new pump stations have been approved to be constructed as a component of the Woodlands at Greystone Development. This Development will also result in the abandonment of the Hamilton Woods Pump Station.

1.1.3 WASTEWATER TREATMENT PLANT

The Wastewater Treatment Plant (WWTP) is currently rated for an Annual Average Flow capacity of 6.0 million gallons per day (MGD) with a maximum monthly hydraulic design capacity of 9.0 MGD and a peak flow capacity of 15.0 MGD. The facility operates under NPDES Permit No. PA0028584 with surface discharge of treated effluent to Goose Creek. The Annual Average Flow to the WWTP in 2017 was 4.6 MGD and the Maximum Monthly Flow was 5.185 MGD, recorded in April 2017. The average monthly organic loading to the plant was 6,170, significantly lower than the facility's organic load capacity of approximately 17,514 lbs/day.

Unit processes employed at the WWTP include new mechanical fine screening and vortex grit removal (expected to be on-line in 2018), flow equalization, primary clarification, trickling filters (roughing), aeration, secondary clarification, polishing (tertiary) clarification, and ultraviolet light disinfection. Waste activated sludge (WAS) and primary sludge generated by the facility are stabilized via anaerobic digestion and further dewatered via two (2) Ashbrook belt filter presses. The dewatered sludge is hauled to the Chester County Solids Waste Authority Landfill for disposal.

As provided in the 2017 Annual Wasteload Report (Chapter 94 Report) submitted to the Pennsylvania Department of Environmental Protection (PADEP), the WWTP currently possesses additional hydraulic and organic treatment capacity to accommodate projected future growth and development within the surrounding communities and West Goshen Township.

Inflow and infiltration (I/I) continue to be an issue as aging and deteriorating infrastructure in the collection system is identified, inventoried, and planned for rehabilitation or replacement. Although it is too early to definitively determine, it appears that repairs completed in 2016, including the disconnection of a cross-connection between a storm water detention pond and the sewer system have resulted in reduced peak and average flows to the WWTP. This decrease in flows should provide a direct return on investment for repairs being made in the collection and conveyance system.

As included in the Authority's Capital Improvement Program and allotted for in their capital expenditure schedule, certain unit processes and components of the treatment facility will require rehabilitation or upgrade within the 5-year planning term due to deterioration from age, existing condition, or inadequate operability/lack of functionality of the current equipment.

Additionally, the pending implementation of a Total Maximum Daily Load (TMDL) for total phosphorus (TP) on point-source discharges within the Goose Creek watershed may significantly reduce the allowable discharge of TP from the WWTP from 2.0 mg/L; to the interim limit of 0.8 mg/L, to EPA's ultimate goal of 0.04 mg/L. It is our opinion that the pending TMDL continues to be the largest risk for compliance and sustainability of the existing wastewater system. Numerous meetings were held with US EPA, US Department of Justice (DOJ), and the Delaware Riverkeeper Network in 2017 to discuss resolution of the pending lawsuit concerning the TMDL. Although a draft settlement agreement was to be submitted to the Authority in 2017 for their review and comment, no draft agreement has been received to-date.

1.2 ASSESSMENT, NEEDS, AND DRIVERS

At the request of the Authority, and as required in the 2017 Bond Indenture, Herbert, Rowland & Grubic, Inc. (HRG) has completed the annual inspection and is providing a summary of the following:

1. Operating Data from 2017
2. Condition of the existing system
3. Improvements completed in 2017
4. Recommendations to improve operation, maintenance, or capital infrastructure

This report is intended to satisfy the Bond Indenture requirements as well as to provide an overview of the activities completed for the wastewater system for the Authority and the Township's Board of Supervisors.

2.0 ACKNOWLEDGEMENTS

HRG would like to thank Michael Moffa, Wastewater Superintendent; Jim Leon, Pump Stations Foreman; Bill Hardy, Plant Maintenance Foreman; and the Township Staff for their assistance in the preparation of this Report.

This Report was prepared by Joshua T. Fox, P.E., Regional Service Group Manager for HRG, the Authority's retained engineer, and was reviewed by the Authority and Township Staff prior to issuance.

3.0 ADDITIONAL INFORMATION USED TO COMPLETE THIS REPORT

3.1.1 2017 ANNUAL WASTELOAD MANAGEMENT REPORT (CHAPTER 94)

The 2017 Annual Wasteload Management Report was completed in accordance with Chapter 94 of Title 25 of the Pennsylvania Code and submitted to PA DEP by the March 31 deadline. The Report provides daily information on hydraulic loading for 2017, along with historical context of annual flows over the past five years. The report also provides:

- Detailed organic loading over 2017
- Information on sewer extensions completed or planned in the Township
- Information regarding the anticipated additional EDUs including the pump station with which each EDU is associated
- Detailed sewer system monitoring, maintenance, and repair efforts undertaken in 2017
- An overview of the condition of the sewer system
- Identification of any overflow events that occurred over the past year
- Information on the 10 pump stations in the system, including information about annual average and max daily flows, as well as projected max daily flows over the next two years
- Sludge disposal records
- Contributing municipalities' equivalent Municipal Wasteload Management data, specifically on collection and conveyance facilities tributary to the Authority's system.

3.1.2 NPDES PERMIT

The Authority has an existing NPDES Permit No. 0028584 (Permit). The Permit was set to expire on August 8, 2006 and a new permit has not yet been issued. The Permit sets forth the monitoring and reporting requirements for discharges from the West Goshen Sewage Treatment Plant (Site ID No. 449547), located at 848 South Concord Road, West Chester, PA 19382. The Permit provides Effluent Limitations for Phosphorus and Ammonia as N on an average monthly lbs/day basis. It also provides effluent limitations or reporting requirements for:

- Flow
- CBOD
- Suspended solids
- Fecal coliform
- Dissolved oxygen
- pH
- Copper, lead, and BIS phthalate

The effluent limitations and reporting requirements are based on an effluent discharge rate of 6.0 million gallons per day. A maximum monthly flow of 9.0 million gallons per day is the rated hydraulic capacity of the WWTP and is used to determine whether a hydraulic overload situation exists. An interim effluent limit of 0.8 mg/L (monthly average) total phosphorus goes into effect on January 3, 2019 based on the first interim settlement agreement with US EPA and DRN on the TMDL.

3.1.3 DRAFT TMDL REPORT

A report titled "Nutrient Total Maximum Daily Load in Goose Creek Watershed, Pennsylvania" was prepared by the US EPA and published June 30, 2008. The purpose of the report was to identify impairments and applicable water quality standards and use them to develop Total Maximum Daily Loads (TMDLs) for Goose Creek. The TMDL process establishes allowable loadings of pollutants, and as West Goshen contributes to the Goose Creek watershed, the effluent from the West Goshen WWTP would be subject to any potential TMDLs implemented for Goose Creek.

The TMDL was developed as an average concentration during the growing season from April to October, when the greatest risk for algae growth exists. After the analysis detailed in the report, it was determined that Goose Creek is an effluent-dominated stream regarding total phosphorus contributions. The report provides a target instream concentration of 0.04 mg/L phosphorus, based on the analysis of historic flow data and the dry weather year of 2002. Total phosphorus reductions were applied to MS4 facilities and to wastewater treatment facilities with flows greater than 1.0 MGD, which includes the West Goshen WWTP.

The West Goshen WWTP is not required to adhere to the limits set forth in the report until their individual permit is revised to incorporate those limits. It should be noted that those projected limits as set forth in this document have been objected to by the Authority. Additional testing has been completed by the Authority and submitted to US EPA for consideration.

The Authority is currently trying to negotiate a settlement with US EPA and DRN on this issue.

4.0 CAPITAL IMPROVEMENT CAMPAIGN

4.1 2015 CAPITAL IMPROVEMENT PLAN (CIP)

In 2015, the Township completed a comprehensive review of the wastewater collection, conveyance, and treatment system. The result indicated that significant improvements and capital investments were required to replace aged and deteriorated infrastructure, improve operations and personnel safety, and prepare for future treatment requirements. These recommendations were detailed in the 2015 CIP that was presented to and subsequently adopted by the Authority in 2016. Several capital improvements were started in 2016 using reserve funding. The Authority identified that their capital improvement campaign was going to require additional funding, outside of their existing reserve funds. As a result, the Authority sold sewer revenue and guaranteed sewer revenue bonds to secure \$17,000,000 in additional funding in 2017.

4.2 SUMMARY OF CAPITAL WORK COMPLETED IN 2017

As a result of the Authority's Capital Improvement Program the following work was completed and/or began in 2017:

- Primary Clarifier No. 3 Structural Repairs
 - This Project generally included replacement of the existing effluent launder, bridge, and related appurtenances that were structurally deteriorated and at high risk of failure
 - This Project was completed in 2017
- Emergency Repairs to Anaerobic Digester
 - This Project generally included repair to the existing roof seam between the Operations Building and the Primary Digester to eliminate active gas leaks; and replacement of several gas conditioning and safety equipment to maintain operability of the Primary Digester
 - This work was completed in 2017
- 2016 Sanitary Sewer System Repairs (Contract 16-1):
 - This Project generally included the following:
 - 6 sanitary sewer spot repairs; Church Ave, Maule Lane, & Basin Road
 - 2,020 L.F. of 8-inch diameter cured-in-place pipe lining
 - 77 L.F. of 14-inch diameter cured-in-place pipe lining
 - Replacement of manholes 800-4; WT-3; WT-1; and 1221
 - Rehabilitation of manholes 801-3; WT-4; WT-2; 1206; 1207; 1208; 1553-34; 1553-33; 1553-32; 1553-31; 1553-27; 1553-26
 - This work was completed in 2017
- WWTP Emergency Generator Replacement (Contract 16-2):
 - This Project generally included:
 - Replacement of the existing emergency generator with two (2) 500kw outdoor enclosed, diesel powered emergency generators
 - Automatic transfer switch



Two (2) 500kw Emergency Diesel Generators and Trvstar Permanent Docking Station at WWTP

- Trystar Permanent Docking Station for manual transfer of power to portable generators
 - Removal of 4,000 gallon underground fuel oil storage tank (leaking)
 - This Project has been completed
- Headworks Improvement Project (Contract Nos. 17-1 and 17-2)
 - This Project generally included:
 - Replacement of the gear boxes, motors, lower bearing assemblies, and grease pumps for the three (3) Screw Pump Control Panel in hazardous rated area. New Screw Pump Control Panel was installed in Headworks Electrical Room
 - Replaced existing mechanical fine screen and manual bar screen with two (2) mechanical fine screens; installed new screen control panel
 - Replaced one (1) existing screenings screw conveyor with two (2) new conveyors
 - Replaced non-functional aerated grit removal system with vortex style grit removal system including new control panel, grit classifier, grit conveyor, isolation gates, and Headworks building addition
 - Replaced existing utility water strainer and pump system to provide additional utility water for grit removal and screenings washing
 - Replaced existing ventilation and lighting to comply with hazardous rated area and replace non-functioning equipment
 - Replace existing deteriorated doors, concrete finishes, and associated appurtenances
 - Manual Transfer Switch and receptacle for a towable emergency generator for redundant back-up power for the Headworks Building
 - This Project is underway and is expected to be completed in 2018. Major equipment installed to date includes the screw pump gear boxes, explosion proof motors, new mechanical fine screens and conveyors, and new equipment control panels.
- Wastewater Pump Stations Bypass Facilities Project (Contract No. 17-4):
 - This Project generally includes providing bypass pump connections to support emergency operations, as well as planned Pump Station Phase II Improvements, at the following locations:
 - Westtown Way Pump Station
 - Washington Street Pump Station

- Taylor Run Pump Station
 - Trinity Drive Pump Station
 - Spruce Avenue Pump Station
 - Montgomery Avenue Pump Station
 - Ellis Lane Pump Station
- This Project will be completed in April 2018
- 2017 Sanitary Sewer System Repairs (Contract No. 17-5):
 - This Project generally includes:
 - Replacement of sewers between manholes 317 and 316
 - 8 sanitary sewer spot repairs; Caswallen Drive; Oak Circle; Isabel Lane; Spring Lane; Spring Valley Lane; Oak Lane; and Paoli Pike
 - 5,761 L.F. of 8-inch diameter cured-in-place pipe lining
 - 7997 L.F. of 30-inch diameter cured-in-place pipe lining
 - Replacement of manholes 801-16; 801-14; and 326
 - Rehabilitation of manholes 54 manholes
 - Replacement of three air release valves
 - This Project will be completed in 2018
- Anaerobic Digester Replacement Project (Contract Nos. 17-3, 17-6, and 17-7):
 - This Project generally includes replacement of:
 - Existing Primary and Secondary Anaerobic Digester
 - Digester mixing
 - Sludge recirculation pumps
 - Dual fuel source boiler
 - Gas conditioning equipment
 - NFPA and NEC improvements
 - Replace roof for the Operations Building
 - Waste gas burner
 - Improved controls and instrumentation

- Replace primary (raw) sludge pumps
- Replace deteriorated doors and windows, repairs to building, new finishes, and removal of asbestos containing materials
- New waste-activated sludge return to Primary Clarifiers
- New natural gas service
- Driveway entrance improvements
- This Project is expected to be completed in 2019
- Enhanced Chemical Addition Project (Contract Nos. 17-8 and 17-9):
 - This Project generally includes replacement of the existing hydrated lime and polyaluminum chloride (PAC) feed systems, orthophosphate and pH controls, and new chemical feed piping for improved injection points to provide chemical removal of total phosphorus and related pH control to meet the interim effluent limit of 0.8 mg/L
 - This Project will be completed in 2018 and was funded in part by a Commonwealth Financing Authority Small Water and Sewer Grant

5.0 WASTEWATER TREATMENT PLANT PRIORITIZATION

5.1 OVERVIEW

As described in Section 1.1.3, the WWTP requires modifications and upgrades over the next several years to replace aged and deteriorated equipment, improve operations, and comply with pending effluent requirements. While the WWTP currently has sufficient organic and hydraulic capacity, aging equipment and overall condition of various components and processes have led to the need for repair or replacement of several key components. Additionally, the prospect of a stricter TMDL requires that any recommended upgrades or repairs be compatible with potential upgrades for phosphorus removal. An overview of the condition of each of the unit processes at the WWTP are noted below:

5.2 HEADWORKS

The WWTP headworks facility is in the process of being upgraded as provided in the description of the Headworks Improvement Project noted above.

Based on HRG's review of the WWTP and discussions with the Operations Staff, the following items have been noted:

5.2.1 INFLUENT SCREW PUMPS

- Gearboxes, motors, and grease pumps were replaced on all three (3) screw pumps. A new control panel was installed in the garage area and new explosion proof local disconnects and emergency stops were installed in the Headworks Screening Room

- Lower bearing assemblies were purchased as part of the Headworks Improvement Project and are expected to be installed in 2018
- Screw pump flight shafts exhibited signs of rust; show be cleaned and re-primed within next two years
- Staff shall document and perform routine operation and maintenance (O&M) work in accordance with the manufacturer's preventive maintenance (PM) schedules

5.2.2 MECHANICAL FINE SCREENS

- New mechanical fine screens were installed in 2017 and are currently in operation
- Signs of rust are already visible on the new equipment. We recommend that the tubes and cover be cleaned with citric acid to remove the rust and traces of iron causing the rust to protect the equipment in accordance with the O&M Manual
- Staff shall document and perform routine operation and maintenance (O&M) work in accordance with the manufacturer's preventive maintenance (PM) schedules

5.2.3 GRIT REMOVAL SYSTEM

- The new grit removal system was purchased in 2017 as part of the Headworks Improvement Project but has not yet been installed. It is expected to be installed by May 2018

5.2.4 EQUALIZATION BASIN

- EQ Pump No. 1 was replaced in 2017
- EQ Blower No. 3 was rebuilt in 2017
- The equalization system is in good working order with no major deficiencies noted. The return activated sludge line is being removed from the influent (EQ) and returned to the Primary Clarifier Distribution Chamber. This change is intended to improve operations.
- Township Staff should drain and clean the EQ Tank in 2018 following construction of the grit removal system to remove accumulated grit from the system
- The Authority should consider adding mechanical mixers and dissolved oxygen control system to limit electrical consumption in the future

5.3 SOLIDS HANDLING

The WWTP utilizes anaerobic digestion for stabilization of the WAS and primary sludge generated at the facility. The stabilized sludge is then further dewatered utilizing Ashbrook belt filter presses prior to ultimate landfill disposal. Additionally, the WWTP also includes dissolved air floatation (DAF) which is not currently in service.

5.3.1 ANAEROBIC DIGESTION FACILITIES

The front-end of the Solids Handling Process is being completely overhauled as part of the Anaerobic Digester Replacement Project (Contract Nos. 17-3, 17-6, and 17-7) due to the age

and condition of the existing facilities. Several gas leaks were identified in the existing building over the past year, only further providing evidence of the need for replacement.

While the existing Operations Building will remain, the existing digesters that share a common wall with the building will be demolished and new precast post-tensioned digesters will be constructed. The new digesters will closely mirror with the existing digesters with a fixed steel cover for the Primary and a floating gas-holder style steel cover the Secondary. Both Digesters will be installed with two draft tube mixers provided in each digester to be able to run the Secondary as a Primary if needed for maintenance purposes. Other improvements include physical separation of the building to provide a physically separated space for the new gas conditioning equipment. Improvements to the Operations Building will also include a new roof, new doors, new windows, and conversion of the lab into office storage space, conversion of the lavatory into an electrical room, replacement of lighting and ventilation, and new finishes throughout.

Other process improvements include replacement of the existing primary sludge pumps, replacement of process piping (both sludge and biogas), replacement of the boiler and heat exchanger, provision of natural gas, additional of alkalinity supplementation pump, and replacement of the sludge recirculation pumps. This work is currently underway and is expected to be completed in 2019.

5.3.2 BELT FILTER PRESSES & ASSOCIATED DEWATERING EQUIPMENT

Stabilized sludge from the anaerobic digester facilities is further dewatered via two Ashbrook 2.2-meter belt filter presses. Sludge dewatering is currently performed approximately 3 to 4 days per week resulting in 438.8 dry metric tons disposed of in 2017 at the Chester County Solids Waste Authority Landfill. The original Type 85 Ashbrook belt filter press was installed in the late 1980s and requires refurbishment or replacement within the 5-year plan period. This unit was last refurbished in 2002 based on discussions with the Operations Staff. Additionally, consideration should be given to refurbishment or replacement of the Type 94 press, installed at the WWTP in 2002.

The Authority is currently evaluating the replacement of the existing belt filter presses with screw presses. When the belt filter presses are replaced, the dewatering building will be upgraded, deteriorated and non-functional equipment will be replaced, and the building will be brought up to current code.

The Township Staff replaced the hydro motor and the water booster pump for Press No. 1 in 2017.

Based on our inspection, the following should be considered for upgrade/replacement as part of the Dewatering System Upgrade, included as part of the Authority's Capital Improvement Campaign:

- Anaerobically digested solids are received in a below-grade wet well located within the sludge pump and polymer mixing area of the current dewatering building. The leaf covers of the access hatch have been removed exposing the building enclosure to hydrogen sulfide gas and resulting in a Class I Div. 1 Hazardous area classification per NFPA 820. Significant corrosion of sludge feed and potable water piping and supports, electrical equipment, mechanical equipment, pump and mixer motors and building and structural support systems has occurred in this area.

- Significant corrosion of motors, manual operators and electrical components associated with the existing belt filter presses was observed. Electrical disconnects are located in close proximity to the presses and are susceptible to water damage from cleaning operations.
- The current dewatered sludge conveyors should be evaluated for replacement to eliminate issues with maintenance and solids loss while operating. This equipment has also experienced corrosion from hydrogen sulfide vapors present within this area. Electrical disconnects for this equipment are susceptible to water damage from cleaning operations.
- The Operations Staff previously removed the sludge grinder equipment installed on the feed piping to the Penn Valley pumps. The control panel and local disconnects for the grinder equipment were left in place. Additionally, there are no flow meters located on the sludge feed piping to record the volumes of anaerobically digested sludge delivered to the belt filter presses.
- General building improvements in the belt filter press area are required including new paint, new corrosion resistant doors and hardware, new lighting, and new mechanical/HVAC systems.
- The belt press control panels are located remotely from the dewatering equipment.
- Due to their age and deterioration resulting from the service environment, refurbishment or complete replacement of both belt filter presses are currently being considered by the Authority as part of the WWTP Phase II Improvements Project. Consideration is being provided to replace the existing equipment with screw presses.
- Replacement of the dewatered sludge conveyors should be considered and may be required dependent on the new dewatering equipment selected.
- Corroded pump motors for the Penn Valley pumps should be replaced with new.
- The re-installation of sludge grinders (macerators) on the sludge feed piping to the Penn Valley pumps should be considered to reduce potential fouling of the pumps. The belt press operator has indicated that the sludge pumps currently operate satisfactorily and additional investigation is required to determine the viability or necessity of sludge grinding.
- All deteriorated sludge feed piping should be replaced and/or receive new paint and labels. We further recommend that flow meters be installed for purpose of recording sludge volumes delivered to the dewatering equipment.
- Replacement of the existing polymer mixing and delivery system should be considered to address corroded and deteriorated equipment, particularly mixers and pumps that have suffered corrosion of electrical motors. However, the belt press operator has indicated that the existing system is functional and the current feed pumps are of satisfactory operation.
- Building renovations to include new vapor-tight LED lighting, paint, corrosion resistant doors and hardware, grating and supports, electrical systems, and HVAC systems should

be performed. Exterior lighting wall packs appear to have reached the end of their useful life and should be replaced with new LED fixtures.

- Heavily corroded electrical disconnects located in the dewatering area should be replaced with NEMA 4 components.
- Deteriorated sections of potable water piping and all backflow preventers and appurtenances should be replaced; insulation and pipe labeling should be installed; a new eyewash station should be installed in close proximity to chemical makeup areas.
- SCADA equipment should be installed to alert WWTP of dewatering equipment failure and record operating parameters.
- In order to remove the Hazardous Area rating in this building, a gasketed steel plate or some other means of permanent separation should be installed above the currently open sludge wet well. It is understood that the belt press operator utilizes the wet well as a means of visualizing sludge quality for press operations and new sample ports installed on the sludge feed piping would provide for similar observation. Alternatively, it may be possible to extend suction piping from the existing Penn Valley Sludge pumps directly to the influent sludge feed from the anaerobic digesters.

Additional investigation of the ability to permanently seal the wet well should be performed. Alternatively, all non-compliant electrical components located within the dewatering building would require replacement with new construction meeting NFPA Class I, Division 2 requirements.

- Following the installation of new media cartridges, the odor control equipment needs to be tested and balanced to ensure proper operation.

5.4 CLARIFIERS

5.4.1 PRIMARY CLARIFIERS

The existing WWTP includes three (3) primary clarifiers, three (3) final clarifiers, and three (3) tertiary (polishing) clarifiers as components of the overall treatment process.

The three (3) primary clarifiers are 70-ft diameter circular center-feed style spiral scraper clarifiers. Two (2) of the three (3) clarifiers were constructed with the original WWTP construction in circa. 1961. The third primary clarifier was constructed in 1975 during the first major expansion project. Primary Clarifier Nos. 1 and 2 appear to be in fair condition.

Primary Clarifier No. 3 was repaired and put back into service in 2017. This clarifier is now in good condition.

All clarifier launders and weirs get cleaned on a regular basis.

5.4.2 FINAL CLARIFIERS

The three (3) final clarifiers are 70-ft diameter circular center-feed style spiral scraper clarifiers. Two (2) of the three (3) were constructed circa. 1975 and follow the aeration basins in the treatment process. The third final clarifier was constructed in 2000 during the expansion of the

WWTP that increased capacity from 4.5 MGD to 6.0 MGD ADF. All three (3) clarifiers appear to be in fair condition.

The clarifier drives and associated clarifier equipment for the two (2) clarifiers constructed in 1975 appear to be original Dorr Oliver equipment. The third clarifier constructed in 2000 is original Envirodyne equipment. The structural support bridges also appear to be original and are in fair condition.

A Total Phosphorus meter and pH meter are being installed on Final Clarifier No. 3 to control the rate of chemical feed for PAC and hydrated lime, respectively as a part of the Enhanced Chemical Addition Project.

All clarifier launders and weirs get cleaned on a regular basis.

5.4.3 TERTIARY (POLISHING) CLARIFIERS

The three (3) tertiary clarifiers are 60-ft diameter circular center-feed style spiral scraper clarifiers. Two (2) of the three (3) clarifiers were constructed with the original WWTP construction in circa. 1961 as final clarifiers following the trickling filters in the treatment process. After modifications and expansion of the WWTP in 2000 the final clarifiers were converted to tertiary clarifiers for "polishing" of the effluent prior to disinfection.

All three (3) clarifiers were taken off-line in the summer of 2017 to be inspected. EVOQUA completed the inspection and provided a report of their findings. A copy of their report can be found in Appendix A.

5.4.4 CLARIFIER RECOMMENDATIONS

- Primary Clarifier Nos. 1 and 2 and all three (3) Final Clarifiers should be taken off-line and inspected in 2018
- Consider installation of weir and launder brushes/cleaning system to reduce required labor for cleaning the Final Clarifiers
- Install TSS and Sludge Level probes for improved wasting operations

5.5 TRICKLING FILTER

The WWTP process includes two (2) roughing trickling filters, 110-ft in diameter with plastic filter media. The roughing filters are intended to reduce the organic loading through distribution of wastewater over fixed film biology that grows on the surface area of the filter media. The wastewater then drains through the underdrain system to the Plant Intermediate Pump Station where it is then pumped to the Aeration Basins.

The trickling filter distribution arms and slag media were replaced with new distribution arms and plastic filter media during the WWTP Upgrade in 2000. The trickling filters are in good condition and should be able to be maintained in good condition, with completion of preventative maintenance for another 5-10 years.

Operations Staff regularly cleans the orifices to ensure equal distribution of primary settled wastewater over the media.

5.6 AERATION (BLOWERS AND AERATION TANKS)

The WWTP utilizes three (3) 125 horsepower 18 psig positive displacement blowers to provide compressed air (capacity of 3,340 scfm each) to the existing aeration tanks through a 16-inch diameter air pipe and the existing aerobic digesters through a 6-inch diameter air pipe. The blowers are able to operate at two (2) variable speed, hi and low.

The blowers were installed in 1975 during expansion of the WWTP with repairs and replacement parts provided as needed. Preventative maintenance is completed regularly for the existing blowers including regularly changing oil, cleaning air filters, etc.



Blowers
125 HP 18 psig PD Blower 3,340 scfm

Overall, the blowers appear to be in good working condition. One (1) blower provides enough air for treatment and mixing of the existing aeration tanks with the second blower providing a swing-stand-by for redundancy, and the third able to provide more than enough air for the aerobic digester that was removed in 2017.

The 16-inch diameter buried aeration piping from the Blower Building to the Aeration Tanks is actively leaking and is visibly rising from the ground when saturated following a rain event.

The existing aeration tanks and blowers provide the WWTP with the ability to be easily modified to achieve greater levels of treatment, including denitrification, if necessary in the future with only minor modifications. Potential future regulatory changes should be considered when making any modifications to this process.

Recommendations:

- Continue with preventative maintenance and develop an inventory of parts to be able to keep blowers in service.
- Replace 16-inch diameter buried aeration piping between Blower Building and Aeration Tank
- Install variable frequency drives (VFDs) on existing blowers to reduce power consumption and improve flexibility and operability of blowers and minimize operating costs
- Install DO sensors in Aeration Basins to improve operability and control blower speed/output
- Reinstall handrail at Aeration Tanks where it was previously removed or damaged

A Small Water and Sewer Grant Application was submitted to the Pennsylvania Commonwealth Financing Authority for 85 percent funding for these improvements. CFA is expected to announce grant awards in July 2018.

5.7 PLANT INTERMEDIATE PUMP STATION

The Plant Intermediate Pump Station collects wastewater received from the underdrain system of the trickling filters (full forward flow) and conveys the flow to the Aeration Basins for secondary biological treatment by way of three (3) 75 HP dry-pit submersible pumps (3800 GPM @ 46 ft TDH @ 885 RPM). The Township Staff rebuilt the bearings for Pump Nos. 1 and 2.

We recommend that all pumping, pumps, and associated equipment be painted and labeled.

5.8 ELECTRICAL

5.8.1 STANDBY GENERATOR REPLACEMENT

Two (2) new 500kw diesel powered outdoor enclosed generators with Trystar Permanent Docking Station and automatic transfer switch were installed at the WWTP in 2017.

5.8.2 ELECTRICAL SAFETY IMPROVEMENTS

None of the existing facilities owned by the Authority are labeled with arc flash or electrical shock hazard warnings. The National Electric Code, Article 110.16, requires all electrical equipment that is likely to require examination, adjustment, servicing, or maintenance while energized to be field marked to warn qualified persons of potential electric arc flash hazards. This does not necessarily mean that an Arc Flash Hazard Analysis (AFHA) is required at every location.

To save costs and to bring the facilities into compliance with the NEC, general labels can be applied to all electrical equipment and a safety program can be developed. The employer is required to implement and document an overall safety program that directs activity appropriate for the electrical hazards, voltage, energy level, and circuit conditions per NFPA 70E, Standard for Electrical Safety in the Workplace. There are specific requirements for training for all employees who face a risk of electrical hazard that is not reduced to a safe level by applicable electrical installation requirements. These employees must be trained to understand the specific hazards associated with electrical energy.

With a developed safety program, there are Tables within NFPA 70E that can be used to determine required personal protective equipment (PPE) levels for equipment required to be serviced. These tables provide pre-defined levels of PPE, which are based on the available short circuit current and the speed of the overcurrent protective device. In order to properly apply the tables from NFPA 70E, some degree of electrical calculations must be performed and the tables could be subject to misuse if they are applied without knowledge of the necessary calculations.

It is this reason that an AFHA complying with the guidelines of IEEE 1584 conducted by an Engineer is recommended. This type of study would label each piece of equipment in a facility with the incident energy level at that specific point in the distribution system. The amount of incident energy determines the exact PPE required to service the particular equipment that is labeled. A fair amount of data collection is required to complete an AFHA study as the existing equipment's manufacturer and model must be surveyed, along with required settings for the entire distribution system. Conductor lengths and sizes must be determined for feeder circuits and conduit types documented.

We recommend that an Arc Flash Study be completed and labeling be installed at the WWTP in 2018. The Pump Stations should be completed as the motor control centers are replaced.

6.0 PUMP STATIONS

The Authority owns and the Township operates and maintains ten (10) wastewater pump stations throughout the collection and conveyance system. The approved Woodlands at Greystone Development includes the construction of two new submersible style pump stations and will result in the decommissioning of the Hamilton Woods Pump Station.

The pump stations were constructed as the West Goshen Township wastewater collection and conveyance system was expanded throughout the Township. The oldest pump stations date back to the early 1960's and repairs and upgrades to the pump stations have been made since that time.

The West Goshen Chapter 94 Report for 2017 identified that the Percent of Max Daily Pump Rate at the Projected 2-Year Max Daily Flow range from 14% to 75%. It should be noted that the flows at the pump stations are based primarily upon recording daily pump run times at a defined pump rate. A few pump stations have discharge flow meters and daily flows are based upon recording totalizer flow meter readings. These methods of flow measurements provide a daily reading of flows through the pump station; however they do not provide an ability to determine the peak flows to the pump station throughout the day.

PADEP requires that each pump station should be capable of handling the peak instantaneous flows tributary to the pump station. Given that some pump stations have had max daily flows greater than 85% in past years, it is likely that these pump stations are experiencing peak influent flows during the day that are greater than the pump stations are rated for. As a result, these pump stations should continue to be monitored, influent flow measured, and inflow and infiltration reduced tributary to the stations. Currently, influent flow is being monitored tributary to the Trinity Drive and Taylor Run Pump Stations.

6.1 #1 MONTGOMERY AVENUE

The Montgomery Avenue Pump Station is a dry pit submersible style pump station constructed in the early 1960's. The pump station structure consists of a below grade concrete dry well and wet well, brick masonry building, and precast concrete plank flat roof decking with a rubber roof. A brick masonry screening room containing equipment to screen the influent wastewater into the pump station wet well was later added (construction date unknown). The screening equipment has since been removed and replaced with a hydraulic driven influent sewage grinder. The sewage grinder is designed to reduce the size of the debris to be pumped in order to minimize the potential for clogging of the pumps, and to convey the debris to the WWTP instead of removing it from the waste stream at the pump station.

This pump station was initially constructed as a duplex (2 identical pumps) station with shaft driven pumps. In 2008, new dry pit submersible style pumps (pump motors connected directly to the pumps) were installed. In addition, a third pump (wet pit submersible) was installed directly in the wet well and a separate header pipe was installed and connected into the existing force main. Township Staff indicated that the third pump was added due to capacity issues experienced at the pump station. The pump station now operates as a triplex style pump station. According to the West Goshen Chapter 94 Report for 2017, this pump station has a

capacity of 175 gpm or (252,000 gallons per day [gpd]), and the Projected 2-Year Max Daily Flow capacity is 75%.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township, test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.

Based on HRG's review of the pump station and through discussion with the Operations Staff, the following deficiencies were noted at the Montgomery Avenue Pump Station. Proposed repairs and rehabilitation items are also listed below:



Montgomery Ave. Bypass Pump
Discharge Connection

- Raw wastewater is conveyed through the screening room below grade vault where the sewage grinder is located. An open grating access hatch, personnel access hatch, and HVAC ductwork penetrations through the floor to the below grade raw wastewater conveyed are located within this room, resulting in a NEC Class I Div. I hazardous area electrical classification. The sewage grinder hydraulic power pack and control panel, electrical equipment, and HVAC equipment located within this room are not rated for use in hazardous areas and significant corrosion of the electrical components was observed.
 - Proposed improvement – Upgrade electrical and HVAC equipment to meet hazardous area requirements. Relocate sewage grinder hydraulic power pack and control panel out of the hazardous rated area. Due to available space requirements and noise associated with the sewage grinder hydraulic power pack, another option may be the installation of a new wall in the screening room to physically separate this equipment from the below grade vault.
- Operations staff reports that the water service hose bibb located in the screening room freezes during the winter. As a result, operations staff drains this unit in the winter to prevent freezing restricting its use.
 - Proposed improvement – Install new water service designed for exterior rated use.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Further investigation is needed to determine the extent of the concrete deterioration throughout the wet well, and this investigation should also include the screen room below grade vault.
 - Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and

possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.

- Operations Staff reported and HRG observed significant grease accumulation in the wet well. Operation staff noted that they currently pump down the wet well and try to pump the grease to the WWTP. Operations Staff reported that this pump station receives wastewater from a number of restaurants and fast-food establishments.
 - Proposed improvement – Investigate requiring/enforcing grease removal at these establishments to remove grease before it enters the wastewater collection system. Also look at installation of a wet well mixing system to keep grease in suspension in the wastewater.
- Concrete cracking, deterioration and exposed rebar in the precast concrete roof planks was observed.
 - Proposed improvement – Repair/replace damaged precast concrete roof planks.
- The screening room rollup door jamb is rotting out at its base.
 - Proposed improvement – Repair existing door jamb.
- Repointing of the brick mortar joints around the exterior of the building is needed.
 - Proposed improvement – Repoint existing brick mortar joints.
- The existing windows and doors in the pump room structure are original. This building is heated in the winter and upgrading of these facilities to new energy efficient units would be beneficial.
 - Proposed improvement – Replace existing door and windows.
- HRG observed infiltration on the intermediate level of the dry well at the force main discharge location and near the HVAC ductwork.
 - Proposed improvement – Seal leaking wall penetrations.
- Corrosion of the building roof access ladder was observed.
 - Proposed improvements - Repaint existing ladder.
- A force main valve box located immediately outside of the pump room entrance door is elevated and creates a tripping hazard.



Montgomery Avenue Concrete
Deterioration

- Proposed improvements – Adjust valve box to match finished grade.
- Operations staff have noted that the pump station has flooded twice in the past 20 years. Staff have sand bags prepared to attempt to keep water from entering the pump dry well.
 - Proposed improvements – Seal/block penetrations in wet well access hatch and the screening room to prevent the inflow of water here as well.
- A method of monitoring flows through the pump station should be provided.
 - Proposed improvements – Install discharge flow meter. Due to configuration of pump header discharge piping in the dry well, there doesn't appear to be enough room to install the flow meter in the existing building. Therefore, the installation of a manhole or vault on the force main outside the building to house the flow meter would be required. This work would also require repairs to the chain link fencing and site paving.
- Gas detection equipment (to verify suitable atmosphere) was not observed in the screen building room or the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the screening room. Consideration for installation of gas detection equipment in the wet well should also be given.
- The existing pumps were installed in 2008. Mechanical equipment typically has an expected service life of 20 years.
- Installation of lighting and a fall protection support system in the wet well should also be considered to improve safety at the station.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station

6.2 #2 TRINITY DRIVE

The Trinity Drive Pump Station originally consisted of a below ground pumping station initially constructed in the early 1960's. The below ground pump station was replaced with a wet pit submersible style pump station in 1993. The pump station consists of an 8' diameter concrete wet well that contains two (2) submersible pumps and a separate concrete valve and flow meter vault.

According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 150 gpm or (216,000 gallons per day [gpd]); and the Projected 2-Year Max Daily Flow capacity is 24%.

The Township Staff rebuilt Pump No. 2 in 2017.

The Township Staff is required to manually operate this pump station by cycling the operation the pumps daily. In the event the pump in the automatic mode would fail, this would require the Township Staff to visit the pump station to put the backup pump into operation. The Township is

currently metering the influent flow to the pump station to identify whether the pumps need to be upgraded.

Township Staff also believe that the existing 4-inch diameter force main, installed in the early 1960s is contributing to the high head conditions impacting the existing pumps and should be replaced. Based on drawings, it appears that this force main is constructed of cast iron pipe. In order to increase the force main to a 6-inch diameter pipe, the pumping rate would have to increase to a minimum 180 gpm in order to achieve a minimum 2 feet per second velocity as required by PA DEP.

Based on HRG's review of the pump station and through discussion with the Township Staff, the following deficiencies were noted at the Trinity Drive Pump Station and proposed repairs and rehabilitation items are listed below and are being included in the currently budgeted Pump Station Phase II Improvement Project:

- Operations staff reports that the water service to the pump station site no longer functions.
 - Proposed improvement – Install new water service to the pump station site.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Concrete deterioration has led to exposed rebar in the concrete.



Trinity Drive Pump Station

- Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.
- HRG observed the existing discharge flow meter was registering active flow on the flow meter totalizer when the pumps were not operating. Township staff reported that they have also noticed this happening. HRG noted there is no data recorder other than the flow meter totalizer to monitor flows.
 - Proposed improvements – Repair or replace existing discharge flow meter. Install new data recorder to record operation of the pump station throughout the day.
- The existing pumps were installed in 1993. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps within the next five years should be considered.
- Installation of a fall protection support system in the wet well should be considered.
- Holes in the existing chain link fence fabric were observed and should be repaired or new fence fabric installed.

- The existing pump station asphalt driveway has deteriorated beyond repair and requires a full depth replacement.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- Evaluate the condition of the existing force main and determine if replacement is required. Tuberculation and corrosion occurring in cast iron pipe can reduce the inside diameter of the pipe and increase the frictional headloss imposed on the pumps leading to a reduced pumping rate. For purposes of this plan, we have assumed replacement of the force main with a new 4-inch diameter pipe.
- Consider installation of an influent sewage grinder to provide protection of the pumps from large debris entering the wet well and possibly clogging the pumps. Since there is no building at this site, the use of a hydraulic power pack driven unit is not recommended due to the noise associated with the units, and a hazardous rated submersible motor driven unit would be recommended.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Because the design of the pump station improvements is under way, the bypass connection provided was a simple tee and valve in the existing valve vault that when upgraded, could be removed and reused. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township, test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.



Trinity Drive Pump Station
Bypass Pump Connection

6.3 #3 SPRUCE AVENUE

The Spruce Avenue Pump Station was originally constructed in the early 1960's. The pump station was rehabilitated with a wet pit submersible style pump station in 1985. The pump station consists of an influent screening manhole, a 9' diameter concrete wet well that contains two (identical) submersible pumps and a separate concrete valve and flow meter vault. The wet well originally contained a trash basket to capture large solids in an effort to protect the pumps. The influent screening manhole contains a fixed trash basket requiring manual cleaning to remove and dispose of the solids captured.

According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 710 gpm or (1,022,400 gallons per day [gpd]) and the Projected 2-Year Max Daily Flow capacity is 40%.

According to the 1983 Drawings a new 10-inch diameter force main was installed as part of the rehabilitation project and the 1960's era 6-inch diameter force main was abandoned.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.



Based on HRG's review of the pump station and through discussion with the Township Staff, the following deficiencies were noted at the Spruce Avenue Pump Station and proposed repairs and rehabilitation items are listed below:

- Raw wastewater is conveyed through the screening manhole and into the wet well, and a drain connects the valve vault to the wet well, resulting in a NEC Class I Div. I hazardous area electrical classification. The electrical lighting contained within these areas are not rated for use in hazardous areas and significant corrosion of the electrical components was observed.
 - Proposed improvement – Upgrade electrical equipment to meet hazardous area requirements.
- Township Staff have noted that the influent trash basket requires constant cleaning to remove debris. In order to fully remove debris, Township staff must enter the screening manhole.
 - Proposed improvement – Demolish the existing fixed trash basket screen and platform in the screening manhole and replace with an influent sewage grinder. Since there is no building at this site, the use of a hydraulic power pack driven unit is not recommended due to the noise associated with the units, and a hazardous rated immersible motor driven unit would be recommended. This installation would also require the installation of a new access hatch for removal of the sewage grinder.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the screening manhole. Concrete deterioration has led to exposed rebar in the concrete.
 - Proposed improvement – Repair deteriorated concrete and install liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.

- Township Staff reports that the water service to the pump station site no longer functions.
 - Proposed improvement – Install new water service to the pump station site.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Concrete deterioration has led to exposed rebar in the concrete.
 - Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.
- Township Staff reported and HRG observed grease accumulation in the wet well. Operation staff noted that they currently pump down the wet well and try to pump the grease to the WWTP.
 - Proposed improvement – Investigate requiring/enforcing grease removal at establishments to remove grease before it enters the wastewater collection system. Also investigate the installation of a wet well mixing system to keep grease in suspension in the wastewater and prevent from accumulating in the wet well.
- Township Staff reports that run off from Spruce Avenue drains to the pump station site causing debris buildup at the pump station fence entrance swing gate. This debris buildup prevents opening of the swing gate until the Township staff can get equipment to remove or shovel the debris away from the gate.
 - Proposed improvement – Site improvements to redirect drainage from Spruce Avenue around the pump station site.
- The existing diesel fuel tank for the emergency generator is buried. Township staff have been removing the buried diesel fuel tanks at the other pump station sites and replacing them with above grade fuel tanks. Township staff would like to install an above grade diesel fuel tank at this site as well.
- It is not known if the existing pumps that were installed in 1985 have been replaced. Mechanical equipment typically has an expected service life of 20 years. If these pumps are original, replacement of these pumps within the next five years should be considered.
- Installation of a fall protection support system in the wet well should be considered.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.

6.4 #6 ELLIS LANE

The Ellis Lane Pump Station is a dry pit submersible style pump station constructed in the early 1960's. The pump station structure consists of a below grade concrete dry well and wet well, brick masonry building, and precast concrete plank flat roof decking with a rubber roof. A brick masonry screening room containing equipment to screen the influent wastewater into the pump

station wet well was later added (construction date unknown). The screening equipment has since been removed and replaced with a hydraulic driven influent sewage grinder. The sewage grinder is designed to reduce the size of the debris to be pumped in order to minimize the potential for clogging of the pumps, and convey the debris to the WWTP instead of removing from the waste stream at the pump station.

This pump station was initially constructed as a duplex (2 identical pumps) station with shaft driven pumps. In 1991, new dry pit submersible style pumps (pump motors connected directly to the pumps) were installed. According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 655 gpm or (943,200 gallons per day [gpd]) and the projected 2-Year Max Daily Flow capacity is 63%.

Based on HRG's review of the pump station and through discussion with the Township Staff, the following deficiencies were noted at the Ellis Lane Pump Station and proposed repairs and rehabilitation items are listed below:

- Raw wastewater is conveyed through the screening room below grade vault where the sewage grinder is located. An open grating access hatch, personnel access hatch, and HVAC ductwork penetrations through the floor to the below grade raw wastewater conveyed are located within this room, resulting in a NEC Class I Div. I hazardous area electrical classification. The sewage grinder hydraulic power pack and control panel, electrical equipment, and HVAC equipment located within this room are not rated for use in hazardous areas and significant corrosion of the electrical components was observed.
 - Proposed improvement – Upgrade electrical and HVAC equipment to meet hazardous area requirements. Relocate sewage grinder hydraulic power pack and control panel out of the hazardous rated area. Due to available space requirements and noise associated with the sewage grinder hydraulic power pack, another option may be the installation of a new wall in the screening room to physically separate this equipment from the below grade vault.
- Township Staff reports that the water service hose bibb located in the screening room freezes during the winter. As a result, operations staff drains this unit in the winter to prevent freezing restricting its use.
 - Proposed improvement – Install new water service designed for exterior rated use.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Further investigation is needed to determine the extent of the concrete deterioration throughout the wet well, and this investigation should also include the screen room below grade vault.
 - Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration. Replace existing wet well access ladder and wet well access hatches.
- Abandoned pipe and HVAC penetrations in the existing building should be blocked in.

- The screening room rollup door jamb is rotting out at its base.
 - Proposed improvement – Repair existing door jamb.
- Repointing of the brick mortar joints around the exterior of the building is needed.
 - Proposed improvement – Repoint existing brick mortar joints.
- The existing windows and doors in the pump and screening room structures are original. These buildings are heated in the winter and upgrading of these facilities to new energy efficient units would be beneficial.
 - Proposed improvement – Replace existing door and windows.
- The elevated equipment pads that had supported the pump motors on the ground level floor are still present and create a tripping hazard.
 - Proposed improvement – Demolish the elevated equipment pads to provide a level floor.
- Infiltration on the intermediate level of the dry well at the force main discharge location was observed.
 - Proposed improvement – Seal leaking wall penetrations.
- Some of the pump support and header piping concrete thrust blocks on the pump level of the pump building have deteriorated and separated from the floor.
 - Proposed improvement – Install new pump support and header piping concrete thrust supports.
- Corrosion of the building roof access ladder was observed.
 - Proposed improvements - Repaint existing ladder.
- The existing roof scuppers have detached from the building.
 - Proposed improvements – Reattach existing scuppers to the building or replace with new scuppers and downspouts.
- The sidewalk along the rear of the building has cracked and heaved. This is most likely due to the downspout discharge onto the sidewalk and the slope of the surrounding grade not allowing for drainage.
 - Proposed improvements – Regrade area to provide drainage away from the building and replace the sidewalk.
- A method of monitoring flows through the pump station should be provided.
 - Proposed improvements – Install discharge flow meter. Due to configuration of pump header discharge piping in the dry well, there doesn't appear to be enough room to install the flow meter in the existing building. Therefore, the installation of a manhole or vault on the force main outside the building to house

the flow meter would be required. This work would also require repairs to the chain link fencing and site paving.

- Gas detection equipment (to verify suitable atmosphere) was not observed in the screen building room or the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the screening room. Consideration for installation of gas detection equipment in the wet well should also be given.
- The existing pumps were installed in 1991. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps within the next five years should be considered.
- Installation of lighting and a fall protection support system in the wet well should also be considered.
- Holes in the existing chain link fence fabric were observed and should be repaired or new fence fabric installed.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.

#10 WOODCREST (DOWNING AVENUE)

The Woodcrest (Downing Avenue) Pump Station consists of a below ground pumping station constructed in 1976. The pump station consists of a 6' diameter concrete wet well that contains an influent sewage comminutor and a separate below grade 8' diameter steel and concrete dry well containing two (identical) dry pit submersible pumps, the pump controls, and emergency generator transfer switch.

According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 100 gpm or (144,000 gallons per day [gpd]) and the Projected 2-Year Max Daily Flow capacity is 14%.



Woodcrest Deterioration

This pump station is being replaced with a typical submersible style pump station. Design of the new pumps station began in 2017 and is expected to be constructed in 2018.

6.5 #11 TAYLOR RUN

The Taylor Run Pump Station is a dry pit submersible style pump station constructed in the mid 1970's. The pump station structure consists of a single brick masonry building containing a concrete dry well and wet well. The wet well portion of the building originally contained equipment to screen the influent wastewater.

This pump station was initially constructed as a duplex series style station with shaft driven pumps (4 total) with provisions for the installation of a third set of pumps (6 total) in the future. Due to high head operating condition of the pump station, series pumping is utilized. It is unknown when the third set of pumps (dry pit submersible style) were installed. In 2003, alterations and additions were made to the pump station including replacing the original four shaft driven pumps with new dry pit submersible style pumps (pump motors connected directly to the pumps) replacement of valves and associated piping, removal of the screening equipment and replacement with a hydraulic driven influent sewage grinder, and installation of overhead steel bridge crane system for pump removal. According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 2,000 gpm or (2,880,000 gallons per day [gpd]) and the Projected 2-Year Max Daily Flow capacity is 57%.

Based on HRG's review of the pump station and through discussion with the operations staff, the following deficiencies were noted at the Taylor Run Pump Station. Proposed repairs and rehabilitation items are listed.

- The pump station portion of the building containing all of the electrical gear, emergency generator, and pumps is not physically separated from the wet well portion of the building; a door connects these areas, resulting in a NEC Class I Div. I hazardous area electrical classification for the entire structure. All of the electrical and HVAC equipment in the dry well and the wet well are not rated for use in hazardous areas. In addition, significant corrosion of the electrical components in the wet well was observed.
 - Proposed improvement – Block doorway between pump room and wet well to physically separate wet well from the rest of the building. Upgrade electrical and HVAC equipment in the wet well to meet hazardous area requirements. Relocate sewage grinder hydraulic power pack out of the hazardous rated area.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Further investigation is needed to determine the extent of the concrete deterioration throughout the wet well.
 - Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.
- The existing windows and doors in the building are original. The building is heated in the winter and upgrading of these facilities to new energy efficient units would be beneficial.
 - Proposed improvement – Replace existing door and windows.

- All HVAC equipment in the building is original and Township staff reports that various units no longer function.
 - Proposed improvement – Repair, replace and upgrade existing HVAC equipment. Block in any building penetrations no longer needed.
- HRG observed infiltration on the pump level of the dry well at various locations.
 - Proposed improvement – Seal leaking wall penetrations.
- Township Staff reported and HRG confirmed with the equipment representative that the existing Safetronics VFDs are no longer supported by the manufacturer and obtaining parts to repair is very difficult.
 - Proposed improvement – Install new VFDs.
- HRG observed that the existing electrical conduit on the pump level of the dry well has corroded and failed.
 - Proposed improvement – Install new electrical conduit, including lights, switches, and outlets.
- The existing emergency generator is original to the pump station and Township Staff reported that the radiator leaks. Township Staff have requested that the existing generator be replaced and prefer the installation of an exterior rated emergency generator.
- The existing diesel fuel tank for the emergency generator is buried. Township Staff have been removing the buried diesel fuel tanks at the other pump station sites and replacing them with above grade fuel tanks. Township Staff would like to install an above grade diesel fuel tank at this site as well. If the emergency generator is replaced with an exterior rated unit, a subbase fuel tank can be combined into the base for the new generator.
- The existing electrical motor control center (MCC) is original to the station and Township Staff have requested replacement of the existing MCC. Replacement of the electrical MCC should be considered.
- A method of monitoring flows through the pump station should be provided.
 - Proposed improvements – Install discharge flow meter. Due to configuration of pump header discharge piping in the dry well, the installation of a standard magnetic flow meter may not be possible due to straight pipe requirement before and after the meter, but a Toshiba Mount Anywhere magnetic flow meter which doesn't have the same straight pipe requirements could be installed.
- Gas detection equipment (to verify suitable atmosphere) was not observed in the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the wet well.

- The existing pumps were installed in 2003. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps due to age within the next five years is not anticipated.
- Holes in the existing chain link fence fabric were observed and should be repaired or new fence fabric installed.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- The pump station asphalt pavement was previously milled for a new overlay. Township staff noted that the overlay is planned to be completed after exterior electrical transformer work is conducted.
- The existing medium voltage service is owned/maintained by the Authority/Township. The service should be replaced. One option is to replace the medium voltage gear in kind, and West Goshen will retain ownership and maintenance responsibilities for the service. The second option would be to convert the station to receive secondary power from the utility, transferring ownership and maintenance to the utility. The first option has a higher up-front capital investment, while the second option would have a smaller initial cost with higher periodic costs to the utility. Given the fact that West Goshen must subcontract the maintenance work, it is recommended that the conversion to secondary power be done.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.

6.6 #12 WASHINGTON STREET

The Washington Street Pump Station is a dry pit submersible style pump station constructed in the late 1970's. The pump station structure consists of a single brick masonry building containing a concrete dry well and an exterior concrete wet well that shares a common wall with the building.

This pump station was initially constructed as a duplex style station with shaft driven pumps with provisions for the installation of a third pump in the future. It is unknown when the third of pump was installed, but in the current pumps were installed in 2008. The current pumps consist of two – 200 HP shaft driven pumps and one – 75 HP shaft driven jockey pump. The wet well initially contained an influent comminutor, this has since been replaced with a hydraulic driven influent sewage grinder. According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 3,800 gpm or (5,472,000 gallons per day [gpd]) and the projected 2-Year Max Daily Flow capacity is 32%.

The Township Staff rebuilt the jockey pump in 2017.

Based on HRG's review of the pump station and through discussion with the operations staff, the following deficiencies were noted at the Washington Street Pump Station. Proposed repairs and rehabilitation items are listed.

- The wet well contains raw waste which results in a NEC Class I Div. I hazardous area electrical classification. The electrical lighting in the wet well is not rated for use in hazardous areas. In addition, significant corrosion of the electrical components in the wet well was observed.

- Proposed improvement – Upgrade electrical equipment in the wet well to meet hazardous area requirements.



Washington Street Equipment

- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Further investigation is needed to determine the extent of the concrete deterioration throughout the wet well.

- Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.

- HRG observed staining on the front of the building that appeared to come from a roof leak. Township Staff noted that the flat roof was replaced in the past few years. Further investigation should be conducted to determine if the staining is from an active leak and appropriate repairs made based upon the results.

- Proposed improvement – Replace existing door and windows.

- All HVAC equipment in the building is original and Township staff reports that various units no longer function.

- Proposed improvement – Repair, replace and upgrade existing HVAC equipment. Block in any building penetrations no longer needed.

- HRG observed that the existing electrical conduit on the pump level of the dry well has corroded and failed.

- Proposed improvement – Install new electrical conduit, including lights, switches, and outlets.

- The existing emergency generator is original to the pump station. Township Staff have requested that the existing generator be replaced and prefer the installation of an exterior rated emergency generator.
- The existing diesel fuel tank for the emergency generator is located and vented inside of the building. This fuel tank should be vented outside of the pump station. If the emergency generator is replaced with an exterior rated unit, a subbase fuel tank can be combined into the base for the new generator.
- The existing electrical motor control center (MCC) and motor starters appear to be original to the station and Township Staff have requested replacement of the existing MCC and motor starters. Replacement of the electrical MCC and motor starters should be considered.
- A method of monitoring flows through the pump station should be provided.
 - Proposed improvements – Install discharge flow meter. Due to configuration of pump header discharge piping in the dry well, the installation of a standard magnetic flow meter may not be possible due to straight pipe requirement before and after the meter, but a Toshiba Mount Anywhere magnetic flow meter which doesn't have the same straight pipe requirements could be installed.
- Gas detection equipment (to verify suitable atmosphere) was not observed in the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the wet well.
- The existing pumps were installed in 2008. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps due to age within the next five years is not anticipated. Township Staff have been transitioning from shaft driven pumps to dry pit submersible style pumps as pump stations are upgraded. Future upgrades to this station should consider evaluating this transition here as well.
- Holes in the existing chain link fence fabric were observed and should be repaired or new fence fabric installed. In addition, the swing gate on the fence should be replaced.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- The storm sewer/drainage pipe across the pump station driveway appears to be in need of replacement.
- Township Staff reported that they have received odor complaints from residents near the intersection of Circle Avenue and Lauber Lane. An air release valve for the force main is located at this intersection.
 - Proposed improvement – Installation of chemical addition equipment at the pump station to inject chemicals, such as Thioguard (magnesium hydroxide) into the wastewater to mitigate the generation of odor in the force main.

- The existing medium voltage service is owned/maintained by the Authority/Township. The service should be replaced. One option is to replace the medium voltage gear in kind, and West Goshen will retain ownership and maintenance responsibilities for the service. The second option would be to convert the station to receive secondary power from the utility, transferring ownership and maintenance to the utility. The first option has a higher up-front capital investment, while the second option would have a smaller initial cost with higher periodic costs to the utility. Given the fact that West Goshen must subcontract the maintenance work, it is recommended that the conversion to secondary power be done.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.

6.7 #13 WESTTOWN WAY

The Westtown Way Pump Station is a dry pit submersible style pump station constructed in the late 1970's. The pump station structure consists of a single brick masonry building containing a concrete dry well and an exterior concrete wet well that shares a common wall with the building.

This pump station was initially constructed as a duplex style station with shaft driven pumps with provisions for the installation of a third pump in the future. It is unknown when the third of pump was installed, but in the current pumps were installed in 2001. The current pumps consist of two – shaft driven pumps and one dry pit submersible pump. The wet well initially contained an influent comminutor, this has since been replaced with a hydraulic driven influent sewage grinder. According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 5,400 gpm or (7,776,000 gallons per day [gpd]) and the projected 2-Year Max Daily Flow capacity is 33%.

Based on HRG's review of the pump station and through discussion with the Township Staff, the following deficiencies were noted at the Westtown Way Pump Station and proposed repairs and rehabilitation items are listed below:

- The current means and method of pump and motor removal at the pump station is very difficult as the floor openings are not located above the pumps. This requires Township Staff to have to maneuver the pumps and motors horizontally in order to lift the pumps out. Township Staff reported that an employee was injured during this work in the past. The installation of a pump removal system similar to that installed at Taylor Run Pump Station should be considered. For purposes of this Plan we have not included an estimated cost of this system. A study must be performed to determine the structural requirements needed for the pump removal system and what if any improvements must be made to the building to support it.
- The wet well contains raw waste which results in a NEC Class I Div. I hazardous area electrical classification. The electrical lighting in the wet well is not rated for use in

hazardous areas. In addition, significant corrosion of the electrical components in the wet well was observed.

- Proposed improvement – Upgrade electrical equipment in the wet well to meet hazardous area requirements.
- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. Further investigation is needed to determine the extent of the concrete deterioration throughout the wet well.
- Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.
- Township Staff reported and HRG observed grease accumulation in the wet well. Operation staff noted that they currently pump down the wet well and try to pump the grease to the WWTP.
 - Proposed improvement – Investigate requiring/enforcing grease removal at establishments to remove grease before it enters the wastewater collection system. Also investigate the installation of a wet well mixing system to keep grease in suspension in the wastewater and prevent from accumulating in the wet well.



- Township Staff noted that they have discovered significant amounts of grit settling out in the influent channel and interceptor piping upstream of the pump station. The headloss associated with the influent sewage grinder can cause water to backup into the interceptor piping.
 - Proposed improvement – Relocation of the influent sewage grinder to the end of the influent channel to reduce the headloss impact. This may require the installation of new a new railing system to support the sewage grinder.
- The existing windows in the building are original. The building is heated in the winter and upgrading of these facilities to new energy efficient units would be beneficial.
 - Proposed improvement – Replace existing windows.

- All HVAC equipment in the building is original and Township Staff reports that various units no longer function.
 - Proposed improvement – Repair, replace and upgrade existing HVAC equipment. Block in any building penetrations no longer needed.
- HRG observed infiltration on the pump level of the dry well at various locations.
 - Proposed improvement – Seal leaking wall penetrations.
- Township Staff reported that the floor drain piping in the building is no longer functioning and that they have tried to unclog it but have been unsuccessful.
 - Proposed improvement – Cut new floor drain piping into the floor.
- Township Staff reported that the existing force main discharge gate valve has failed in the open position and can no longer close when necessary.
 - Proposed improvement – Replace existing valve with a new gate valve. This will require the installation of a temporary line stop or new valve outside of the pump station in order to prevent wastewater from draining out of the force main. In addition, a means of maintaining flow through the pump station during this work must be provided.
- The existing emergency generator is original to the pump station. Township staff have requested that the existing generator be replaced and prefer the installation of an exterior rated emergency generator.
- The existing diesel fuel tank for the emergency generator is located outside above the wet well. If the emergency generator is replaced with an exterior rated unit, a subbase fuel tank can be combined into the base for the new generator.
- Township staff reported and HRG confirmed with the equipment representative that the existing Safetronics VFDs are no longer supported by the manufacturer and obtaining parts to repair is very difficult.
 - Proposed improvement – Install new VFDs.
- The existing electrical motor control center (MCC) appear to be original to the station and Township staff have requested replacement of the existing MCC. Replacement of the electrical MCC should be considered.
- A method of monitoring flows through the pump station should be provided.
 - Proposed improvements – Install discharge flow meter. Due to configuration of pump header discharge piping in the dry well, the installation of a standard magnetic flow meter may not be possible due to straight pipe requirement before and after the meter, but a Toshiba Mount Anywhere magnetic flow meter which doesn't have the same straight pipe requirements could be installed.

- Gas detection equipment (to verify suitable atmosphere) was not observed in the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the wet well.
- The existing pumps were installed in 2001. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps due to age within the next five years is not anticipated, however the pumps will be approaching 20 years at the end of five years. Township staff have been transitioning from shaft driven pumps to dry pit submersible style pumps as pump stations are upgraded. Future upgrades to this station should consider evaluating this transition here as well. Township staff have also noted that due to the high head operating conditions associated with this pump station, the switching to series pumping (6 total pumps) may be beneficial. A study to evaluate the effectiveness of switching to a series pumping configuration would have to be performed.
- Holes in the existing chain link fence fabric around the electrical switchgear were observed and should be repaired or new fence fabric installed.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- The existing medium voltage service is owned/maintained by the Authority/Township. The service should be replaced. One option is to replace the medium voltage gear in kind, and West Goshen will retain ownership and maintenance responsibilities for the service. The second option would be to convert the station to receive secondary power from the utility, transferring ownership and maintenance to the utility. The first option has a higher up-front capital investment, while the second option would have a smaller initial cost with higher periodic costs to the utility. Given the fact that West Goshen must subcontract the maintenance work, it is recommended that the conversion to secondary power be done.
- The louver over the wet well should be modified so the base of the louver is more than 18 inches above the top of the wet well tank. The louver size can be reduced, as it is currently sized to allow aspiration of the indoor generator. If the indoor unit is replaced with an outdoor unit, the louver size can be reduced.

Installation of a pump station force main bypass connection was completed in 2017 as a component of Contract 17-4. The bypass connection allows the ability to use the existing force main through use of a bypass pump(s) in the event that the existing pumps are inoperable, and the ability to use the existing pumps to through use of pump and haul or a temporary force main in the event the existing force main is inoperable. Emergency operating procedures were developed for the use of the bypass connection, should it be needed. We recommend that the Township test the procedure developed, make changes as necessary during non-emergency activities, and then standardize the operating procedure for Staff use.

6.8 #16 FERN HILL (NORTHEAST)

The Fern Hill (Northeast) Pump Station is a wet pit submersible style pump station constructed in the early 1990's. The pump station structure consists of a below grade concrete screening area

and wet well with an above grade brick masonry building to house the electric and control panels, an overhang area to cover an emergency generator, and a screening disposal overhang. The screening equipment has since been removed and replaced with a hydraulic driven influent sewage grinder. The sewage grinder is designed to reduce the size of the debris to be pumped in order to minimize the potential for clogging of the pumps, and convey the debris to the WWTP instead of removing from the waste stream at the pump station. An above grade diesel fuel tank for the emergency generator was placed under the screening disposal overhang.

This pump station was initially constructed as a triplex (3 identical pumps) station with submersible pumps. In 2006, new submersible style pumps were installed. According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 2,100 gpm or (3,024,000 gallons per day [gpd]); however the Projected 2-Year Max Daily Flow capacity is 30%

The Township Staff rebuilt Pump No. 3 in 2017 and has removed the sewage grinder for rebuilding. The sewage grinder is expected to be re-installed in 2018 following rebuilding.

Based on HRG's review of the pump station and through discussion with the Township Staff, the following deficiencies were noted at the Fern Hill (Northeast) Pump Station. Proposed repairs and rehabilitation items are listed.

- The wet well contains raw waste which results in a NEC Class I Div. I hazardous area electrical classification. The electrical lighting in the wet well is not rated for use in hazardous areas. In addition, significant corrosion of the electrical components in the wet well was observed.
 - Proposed improvement – Upgrade electrical equipment in the wet well to meet hazardous area requirements.
- The wet well is not physically separated from the electrical room. Additional work should be done to physically separate the electrical gear and provide a safe environment. For example the wire rope hoist is not explosion proof.

- Concrete and ferrous metal deterioration from exposure to hydrogen sulfide gas was observed in the wet well. HRG observed and Township Staff reported that the header piping and valves in the wet well are experiencing severe corrosion. Township staff noted that they have epoxy painted this pipe and valves the past, but the painting has not held up. Further investigation is needed to determine the extent of the concrete and pipe deterioration throughout the wet well.



Fern Hill Equipment

- Proposed improvement – Complete investigation to determine full extent of concrete and ferrous metal deterioration. Repair deteriorated concrete and possibly add liner to prevent future deterioration. Repair and replace ferrous metal as necessary and coat/paint to prevent future deterioration.
- HVAC equipment should be provided in the wet well to provide the proper air changes per hour when Township staff is working in the wet well.
- Infiltration at various locations in the wet well was observed.
 - Proposed improvement – Seal leaking wall locations.
- Multiple holes in the shingle roof were observed. These holes have allowed water to enter and damage the ceiling panels above the generator.
 - Proposed improvement – Install new roof, mitigate any water damage, and repair ceiling.
- The existing emergency generator is original to the pump station. Township staff have requested that the existing generator be replaced and prefer the installation of an exterior rated emergency generator.
- The existing diesel fuel tank for the emergency generator is located under the screening disposal overhang above the wet well. If the emergency generator is replaced with an exterior rated unit, a subbase fuel tank can be combined into the base for the new generator.
- Proposed improvements – Replace existing discharge flow meter. Due to configuration of pump header discharge piping in the dry well, the installation of a standard magnetic flow meter may not be possible due to straight pipe requirement before and after the meter, but a Toshiba Mount Anywhere magnetic flow meter which doesn't have the same straight pipe requirements could be installed. Install new data recorder to record operation of the pump station throughout the day.
- Gas detection equipment (to verify suitable atmosphere) was not observed in the wet well. Operations staff frequently enter these areas when checking and maintaining the pump station.
 - Proposed equipment – Install gas detection equipment in the wet well.
- The existing pumps were installed in 2006. Mechanical equipment typically has an expected service life of 20 years. Replacement of these pumps due to age within the next five years is not anticipated.
- Consider installation of a data logger or influent flow meter to monitor influent flows to the pump station.
- A new roof was installed by the Township in 2016; however, repairs to the ceiling still need to be made. We recommend that these repairs be completed in 2018.

6.9 #17 HAMILTON WOODS

The Hamilton Woods Pump Station is a submersible style pump station that consists of a concrete wet well that contains two submersible pumps and a separate concrete valve and flow meter vault. The wet well originally contained a trash basket to capture large solids in an effort to protect the pumps. The trash basket required manual cleaning to remove and dispose of the solids captured. Township Staff have since removed the trash basket and reported to HRG that they have not had issues with large solids clogging the pumps.

According to the West Goshen Chapter 94 Report for 2017, this pump station has a capacity of 240 gpm or (345,600 gallons per day [gpd]) and the projected 2-Year Max Daily Flow capacity is 28%.

This pump station is planned to be decommissioned following completion of the Woodlands at Greystone Development. Construction of the public improvements for this Development is expected to begin in the spring of 2018.

7.0 COLLECTION SYSTEM

The existing sanitary sewer collection system consists of approximately 225 miles of gravity sewers ranging in size from 8-inches to 30-inches in diameter. Much of the collection system was built in the 1960's and is constructed of asbestos cement and terra-cotta. The terra-cotta is generally located within Township and State rights-of-way while the asbestos cement pipe is generally located within backyards and off-road rights-of-ways. The terra-cotta pipe is highly susceptible to leakage due to the number and types of joints while the asbestos cement pipe is highly prone to failure. The larger diameter interceptor piping is mainly comprised of reinforced concrete.

Due to the age and documented existing conditions of the sanitary sewer system, the Township Staff has been diligently working to clean and inspect as much of the system as possible each year, until the entire system has been inspected. They have concentrated their efforts to-date on known problem areas and areas within the Township that are scheduled to be paved over the next 5 years, to eliminate repaving areas to make necessary repairs.

In 2017, the Township cleaned 39,396 feet and televised 37,441 feet of sewer main and purchased new camera/inspection equipment. Areas that could be repaired by Township Staff were planned for and repaired. The following details some the major sewer line maintenance and repair activities in 2017:

- Repaired two offset joints with pipe patch on Stoneybrook Drive gravity line
- Replaced 14' of clay pipe on Roberts Lane
- Completed a pipe repair between MH 943 and MH 942
- Repaired or replaced 26 manholes

Areas that could not be repaired by Township Staff are included in an annual repair project. In 2017, the following areas were repaired under Contract 17-5:

- Spot Repair No. 1 on Caswallen Drive
- Spot Repair No. 3 on Oak Circle
- Installation of the 8-inch cleanout
- Spot Repair No. 4 on Isabel Lane
- Spot Repair No. 5 on Isabel Lane
- Spot Repair No. 6 on Spring Lane

- Spot Repair No. 7 on Spring Lane
- Spot Repair No. 9 on Paoli Pike
- Spot Repair No. 10 on Mallard Drive
- Replacement of Manhole 326

As part of the repair work that was identified by Township Staff, nearly 1,000 L.F. of 30-inch diameter sewer interceptor and 5,760 L.F. of 8-inch diameter sewer main will be rehabilitated using cured-in-place lining. 53 manholes will also be rehabilitated using trenchless methods.

We recommend that the Authority continue to repair, replace, or rehabilitate sanitary sewer mains, interceptors, and manholes that have been identified to need repair during the inspections completed by the Township Staff.

Additionally, we recommend that the Authority consider completing a multi-sensor inspection of their large interceptor (24 and 30-inch diameter) to determine the condition of the existing piping. Several locations have been found to be in poor shape and due to the size and the cost to rehabilitate, a baseline inspection should be completed. This cannot be completed by Township Staff due to the limitations of their camera equipment.



APPENDIX A
POLISHING CLARIFIER INSPECTION

May 30, 2017

Polishing Clarifier Inspection
West Goshen, PA WWTP
Engineer – HRG - Dennis Michael

Overview

There are three clarifiers 60 foot diameter x 8'-0 SWD. They are Dorr Oliver units with at least the first two units originally installed in the early 1960's. They originally functioned as final stage clarifiers. Over the years another set of final clarifiers was added so these now serve as polishing clarifiers before disinfection.

The original design included a recirculation pipe that took water from a trough around the influent well to a point upstream in the plant. This has since been abandoned.



It should also be noted that these clarifiers do not have a scum skimmer.

Even though the clarifiers are all a Dorr Oliver design, each of the drive units are different.

The clarifiers were drained and inspected on separate days.

Purpose

Inspection of these clarifiers was performed to assess their condition for the purpose of using them in a CoMag process. The findings of this inspection may be used to assess the expected life of these clarifiers for any future use.

Inspection

Clarifier No. 1



Inspection date – May 25, 2017

Drive condition – The drive did not show any signs of casting failure or excessive oil leakage. The clarifier

was not run during the inspection however the two operating clarifiers were running smoothly and without excessive noise. Because of the walkway design, access to some areas of the drive requiring routine maintenance are limited and would not be considered safe by today's standards. With the addition of magnetite in the CoMag process it is not clear that the drive would provide sufficient torque for the additional sludge loading. With regular oil changes as recommended by the manufacture and a good maintenance routine, a clarifier drive can be expected to have a life of 25 years. It is not clear how old this drive is but it could easily be more than 25 years. It is recommended that the drive be replaced.



Submerged steel condition – The submerged steel had a lot of corrosive build-up on the surface. When it was scraped away it was evident there was pitting of the steel. The center pier would be a primary concern since only the exterior could be observed. There were areas on the center pier where it appeared the corrosion was more excessive. The connection of the torque cage to the drive showed additional corrosion because of its location



at the air / water interface. This is a critical point since all of the hanging weight and torque are transmitted through this connection.

Walkway condition – The walkway has corrosion on the diamond plate surface as well as underneath. The outside edge of the diamond plate is wavy which could be the result of corrosion between the mating surfaces.



General - The concrete in this clarifier looked to be in fair condition. A small area of the floor grout at the center of the tank was spalled away and it appeared like the grout was very thin, close to .25". At the tank wall the grout appeared to be closer to 1.50" thick. Of the three polishing clarifier tanks, this one was in the best condition. Overall recommendation is to replace the complete clarifier mechanism including submerged steelwork, walkway and drive.



Clarifier No. 2



Inspection date – May 23, 2017

Drive condition – The condition of the drive in this tank was very similar to what is described above in tank 1. As noted above and shown in this photo, the drive is a different design from the other clarifiers.



Submerged steel condition – The corrosion on the submerged steelwork in this tank is similar to what is noted above

Walkway condition – The condition and corrosion of this walkway is significantly worse than the other two clarifiers

General – Overall this clarifier mechanism is in the worse condition of the three we inspected to date. The condition of the tank would be in between tank 1 and 3. Overall recommendation is to replace the complete clarifier mechanism including submerged steelwork, walkway and drive.



Clarifier No. 3

Inspection date – May 16, 2017

Drive condition – This drive does show signs of oil leakage. It is not clear where the leak originates. It could be a bad seal, a cracked housing or the oil could be displaced by water or overfilling.

Submerged steel condition – Same as noted above for clarifier 1.

Walkway condition – This walkway has some corrosion but is in the best condition of the three.

General – Of the three clarifiers the concrete in this clarifier was in the worse condition. The side walls on all three clarifiers had exposed aggregate. The floor in this tank was scored in several areas that aligned with the tip of a scraper indicating contact had been made at some time. More cracks were evident in the grout than the other tanks. Overall recommendation is to replace the complete clarifier mechanism including submerged steelwork, walkway and drive.



Steven Schmidt



Evoqua Water Technologies LLC